Desiccant "Systems" and Technology Applications Overview

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Distributed Energy

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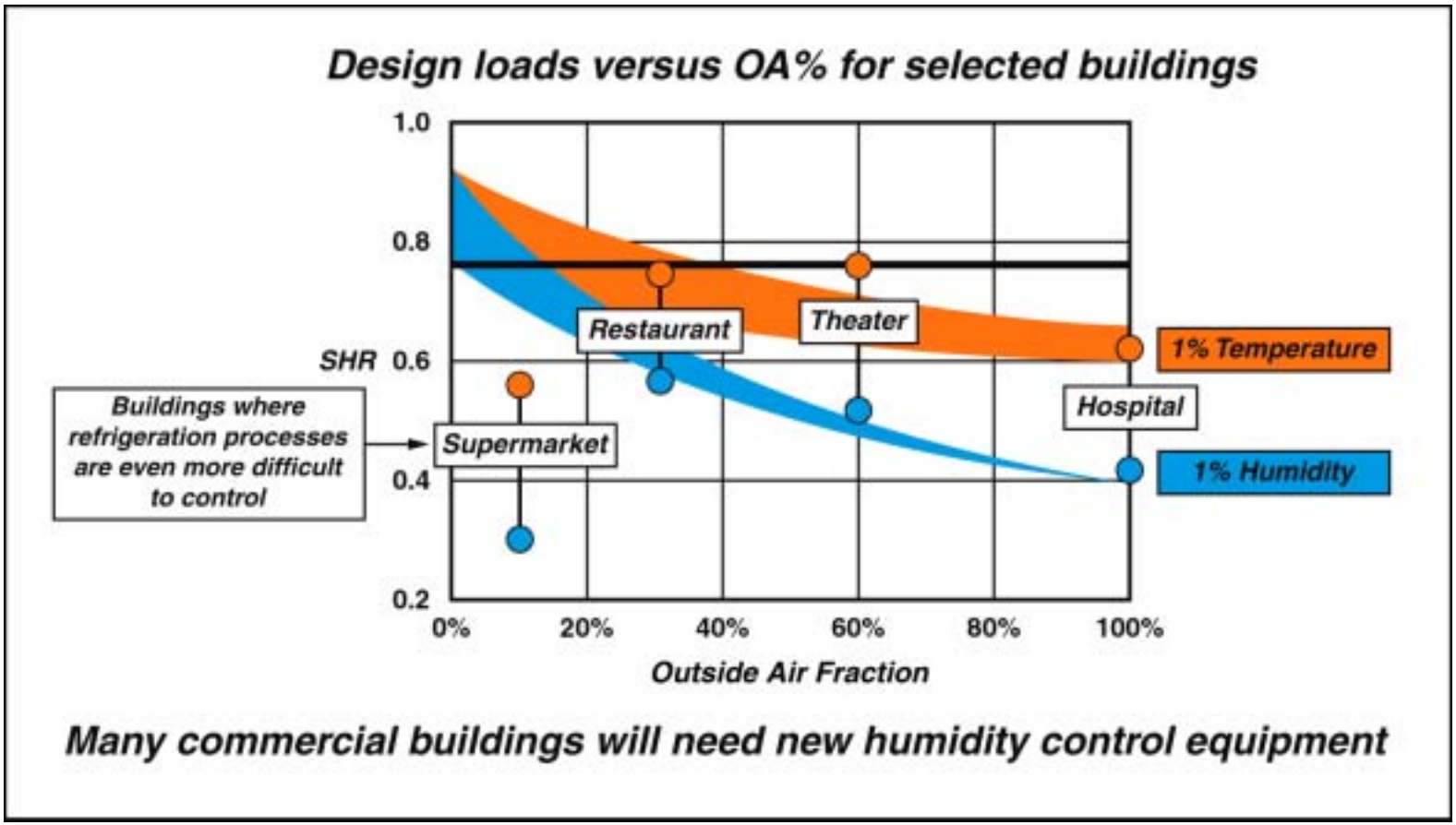
OAK RIDGE NATIONAL LABORATORY

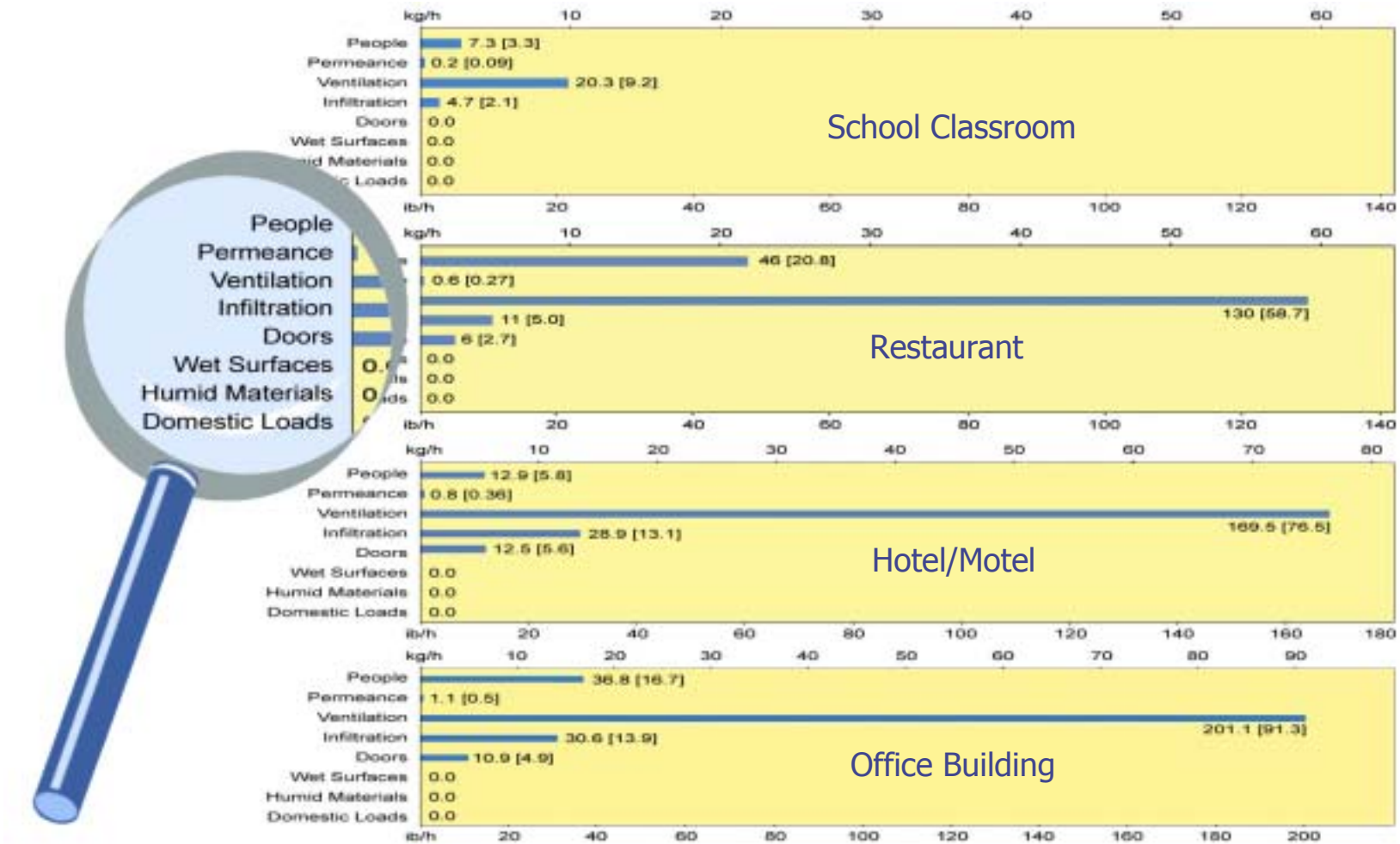
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Indoor Air Quality, Design Loads, Equipment SHR Drivers

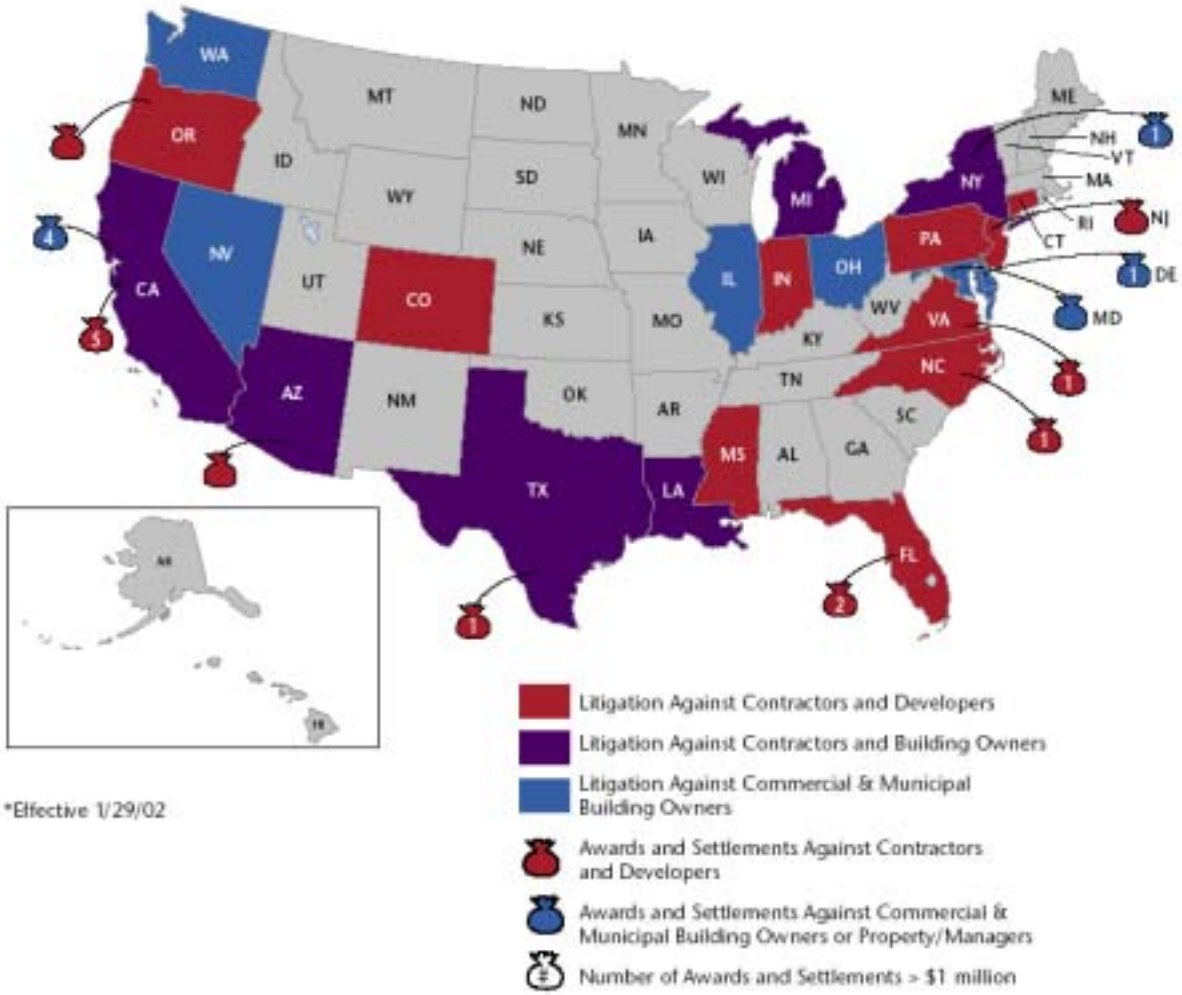
% Outside Air vs. Design Dew Point vs. HVAC SHR



Source of Latent Loads for Various Applications



Mold Litigation Against Contractors and Commercial & Municipal Building Owners



*Effective 1/29/02

Source: Hazardous Times, February 2002

ORNL Advanced Desiccant "Systems" Program

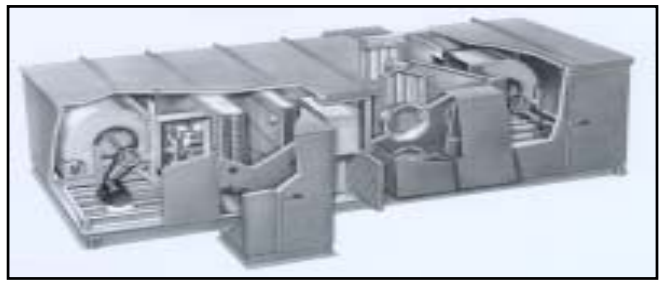
- **Goal:** Facilitate market introduction of cost-effective, energy efficient desiccant-based dehumidification technologies into mainstream HVAC comfort conditioning systems
- **Strategic Approach - Program Plan**
  - ⇨ Industry/user's group plan input
  - ⇨ Market, system Configuration assessments
  - ⇨ Novel/hybrid system prototype development
  - ⇨ Enabling Technologies Development
    - IAQ benefits
    - Sensors/controls technology
    - Product rating and certification
  - ⇨ Integration with CHP Systems

ORNL Contributing to Benchmarking, Enabling Technologies

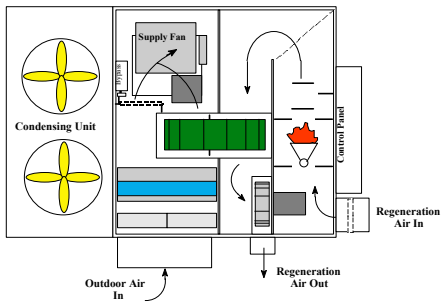
- **Establish IAQ Benefits**
  - Schools IAQ Studies
- **Lab test feedback to manufacturers**
  - ⇨ Higher wheel loading to meet rated capacity
  - ⇨ Latent carryover from thermal wheel reduced
- **Field tests - restaurants schools, hospitals, nursing homes**
- **Rating and Certification Standard**

Prototype Field Installations

- **Active Desiccant/Total Energy Recovery Collaboration**
  Berry College and Georgia Tech Baker Bldg.

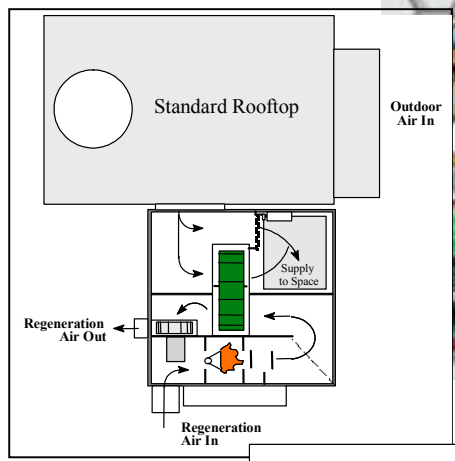


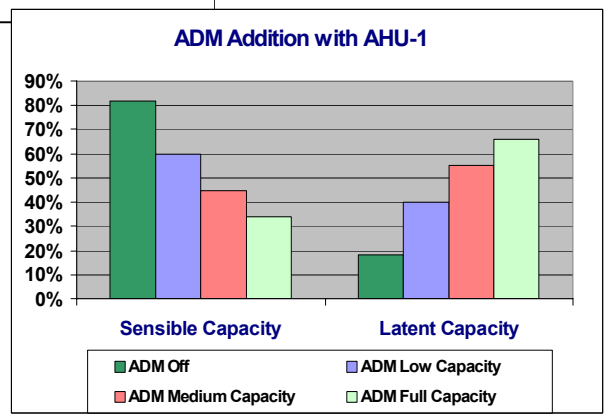
- **Active Desiccant Module**
  Callaway Resort and Golf Club and Chain Restaurant



Latest "Pilot" Installations save Energy + Operating cost and Indoor Air Quality (IAQ)

- Active desiccant module added to existing rooftop idea
- Desiccant wheel *behind* dx cold coil
- Wheel by-pass/blower speeds/ compressor speeds all control SHR performance of the unit



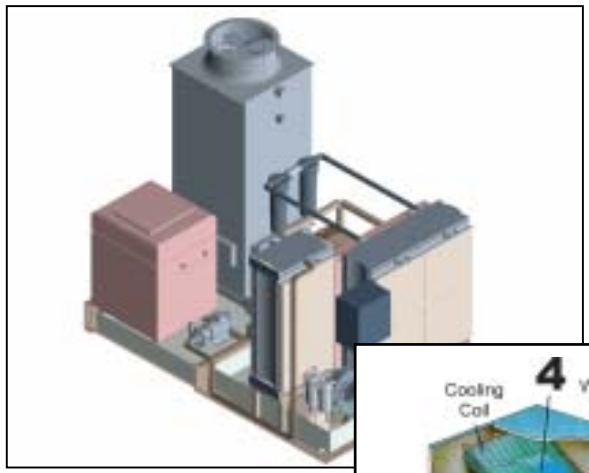


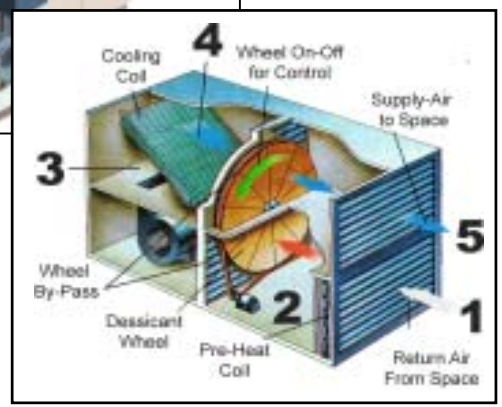
New Products - "Novel/Combined Systems" -

- RFP Winners -

- **Kathabar - AIL Research**

  Rooftop Liquid-Desiccant Air Conditioner (Sensible + Latent)





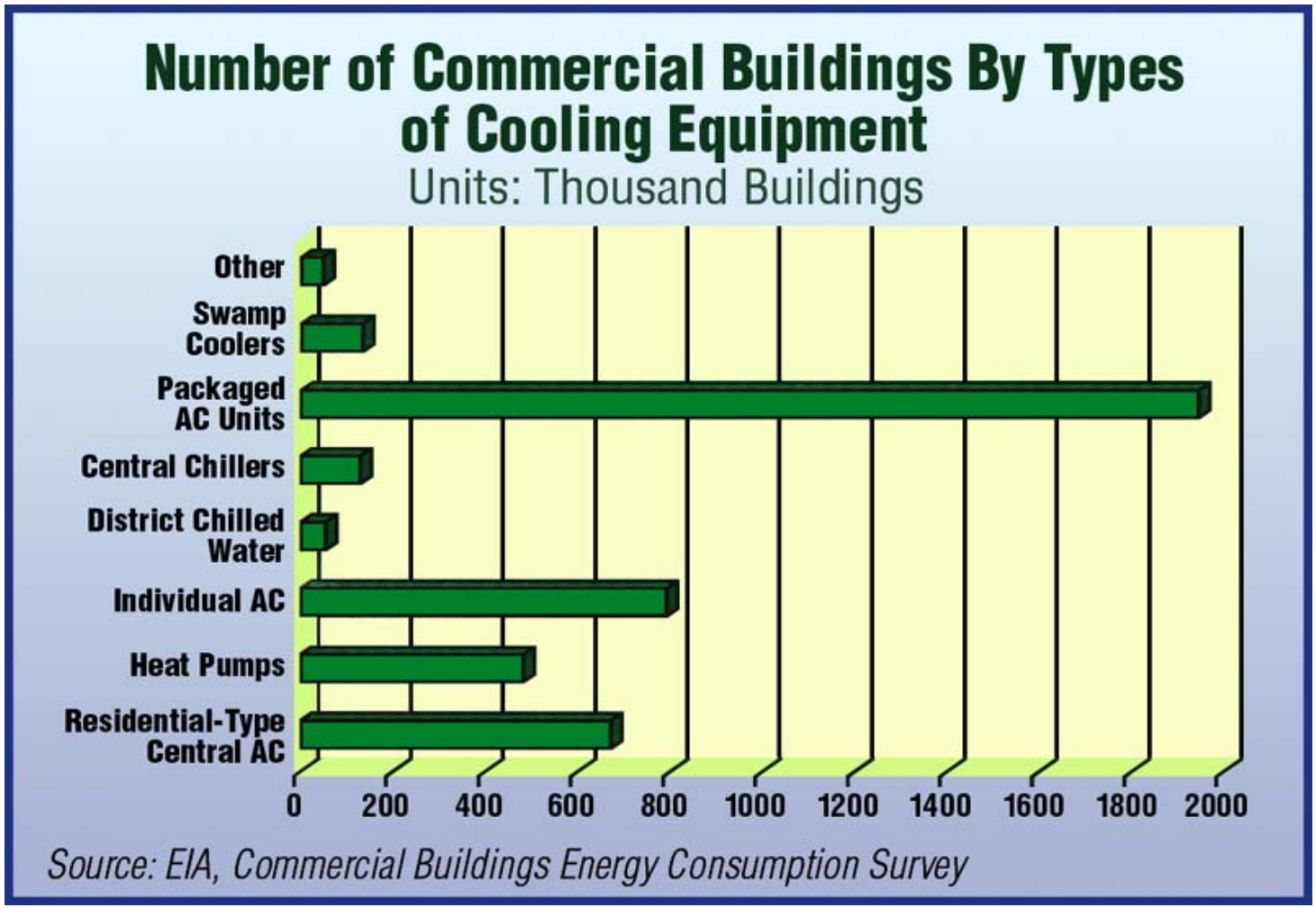
- **Trane/UCF/FSEC/AirXchange -**

  Trane Active Cromer Cycle

- **SEMCO/C&M Engineering/UIC -**

  Active Desiccant/Integrated rooftop hybrid packaged system

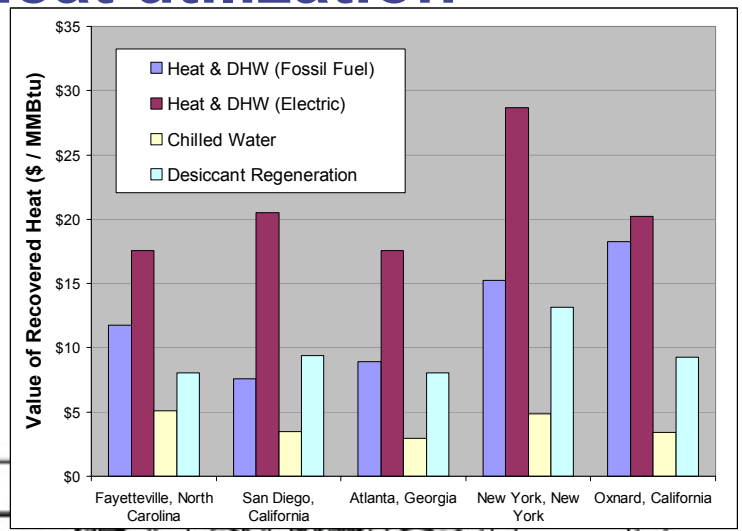
U S HVAC Market is Dominated by Packaged Equipment

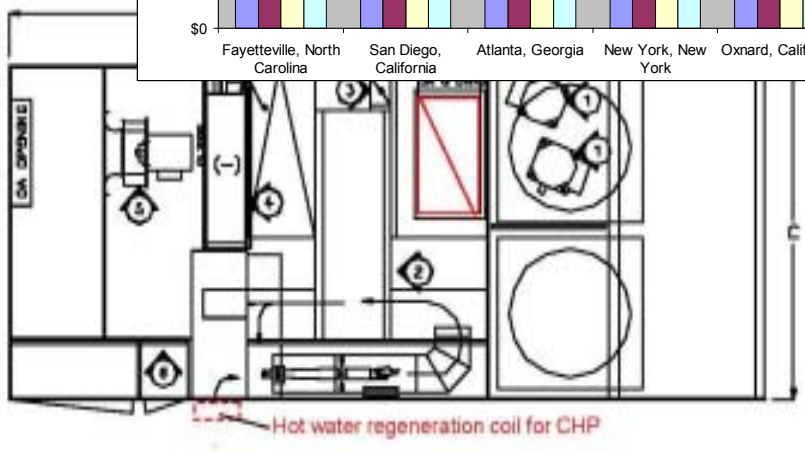


Desiccant Technology CHP/DG Integration

Desiccant regeneration, a thermally activated technology required for efficient DG waste heat utilization

- **Desiccant technology easily adapted to *low quality* waste heat**
  - ⇨ **IC engine jacket heat levels**
  - ⇨ **Fits DG efficiency trends**
- **$ value of waste heat end-use applications**
- **New *Combined System* Desiccant Products CHP friendly**
  - ⇨ **Behind-the-coil design**
  - ⇨ **Liquid Desiccant products**





Desiccant Technology Recent and Future Milestones

Recently Competed Milestones

- Successful pilot installations of active desiccant module(ADM)/rooftop combinations on hotel and restaurant applications
- Completion of controlled lab testing of all three combined-desiccant-system designs with excellent results
- CHP Integration lab results on 1st generation desiccant systems powered with microturbine waste heat--system efficiency determinations
- Formation and progress in adoption of Desiccant *System* MOT leading to certification and comparison rating of products

Future Planned Milestones

- IADM packaged hybrid installation and field evaluations in collaboration with school and national accounts sites
- Field installation of liquid desiccant rooftop combined system concept in conjunction with *Solargenix* (aka Duke Solar)
- Waste Heat regeneration evaluations with new desiccant system designs in ORNL CHP integration lab

Desiccant Technology - Technical & Programmatic Challenges

- Equipment first cost -- operating cost
- Entrenched/established vapor-compression alternative technology and infrastructure
- Small number of commercial desiccant equipment manufacturers

Desiccant Technology Project Risks

- **Real research & development & new applications where "*disappointing or unanticipated*" results are a real possibility**
  - ⇨ **Lessons learned can be an important result despite good technical planning**
  - ⇨ **Persistence often required for success**

- **Standards & ratings activities carried forward in ASHRAE / ARI / ANSI committees populated by members with special interests**

Coordination with Stakeholder Groups, Other EERE Programs

- **Industries --** AirXchange – Munters – SEMCO – Trane – Air Technology Systems (ATS) – Dryomatic – Bry-Air – Kathabar
- **Universities --** University of Illinois-Chicago (UIC) –Georgia Tech Research Institute (GTRI) – University of Central Florida - Kansas State University – etc.
- **Independent Research Groups --** AIL Research – CDH Energy Corp. – FSEC
- **Utilities --** Mississippi Valley Gas – Tampa Electric Company (TECO) – Philadelphia Energy Company (PECO) – Clearwater Gas – Peoples-Gas Miami – United Cities Gas – NICOR – etc.
- **Research Organizations --** ASHRAE – ARI – AGA – GTI (GRI)
- **FEMP - NREL**